Electrical and Computer Engineering Course Descriptions

ELEC-106—Fundamentals of Electrical Engineering
Three Credit Hours
Required of electrical engineering freshmen.
An introduction to the engineering profession, branches and functions of engineering, professional ethics, and the role of engineers in society. Fundamentals of engineering problem solving and the use of calculators and computers as tools to aid in problem solving. Includes subject areas common to most engineering disciplines such as the introduction to the engineering design process and teamwork through a design project, engineering laboratory skills, report writing, and engineering economics, but through the use of electrical engineering exemplars.
Lecture: Three hours

ELEC-201—Electric Circuit Analysis I
Three Credit Hours
Required of electrical engineering sophomores. Circuit elements; Kirchhoff's and Ohm's Law and their application through a variety of circuit analysis techniques; operational amplifiers; and the transient response of simple circuits. The circuit analysis program SPICE is introduced.
Co-requisites: MATH-131, PHYS-221/271

ELEC-202—Electric Circuit Analysis II
Three Credit Hours
Required of electrical engineering sophomores. Sinusoidal analysis and phasors; AC power; three-phase circuits; frequency response of simple circuits; the use of SPICE for ac circuit analysis.
Lecture: Three hours
Prerequisites: ELEC-201 with a grade of C or better or the successful completion of both ELEC-308 and ELEC-204 with grades of C or better. Co-requisites: MATH-132, PHYS-222/272

ELEC-204—Electrical Laboratory
One Credit Hour
Required of electrical engineering sophomores. An introduction to the experimental method in electrical engineering. Laboratory exercises are designed to supplement the material presented in ELEC-201 and ELEC-202.
Laboratory: Two hours
Prerequisites or co-requisite: Electric Circuit Analysis II (ELEC-202) or Elements of Electrical Engineering (ELEC-308)

ELEC-206—Computer Applications for Electrical Engineers
Three Credit Hours
Required of electrical engineering sophomores. The computer is presented as a tool for the solution of engineering problems. High level programming of computers; data manipulation, data plotting, and equation solving using application programs such as MATLAB.
Lecture: Three hours

ELEC-302—Electrical Machinery Laboratory
One Credit Hour
Required of electrical engineering juniors. A laboratory course to accompany ELEC-316.
Laboratory: Two hours
Prerequisite or co-requisite: Electromechanical Energy Conversion (ELEC-316)

ELEC-306—Electronics I
Three Credit Hours
Required of all electrical engineering juniors. Characteristics of solid-state devices, theory and design of low-frequency amplifiers, transistor biasing and stabilization, design of multistage and feedback amplifiers utilizing bipolar and MOS devices.
Lecture: Three hours
Prerequisites: Electric Circuit Analysis II (ELEC-202), Electrical Laboratory (ELEC-204); *Co-requisite*: Electronics Laboratory (ELEC-313).

ELEC 307—Nuclear Engineering
Three Credit Hours
An introduction to the theory and application of nuclear energy. Topics include fission and the chain reaction; nuclear fuels; nuclear reactor principles, concepts, examples, construction, operation, and ecological impact; radiation hazards and shielding; and nuclear propulsion.
Lecture: Three hours
Prerequisites: Physics with Calculus II/Laboratory for Physics with Calculus II (PHYS-222/272).

ELEC-308—Elements of Electrical Engineering
Three Credit Hours
Fundamental electrical concepts and units; basic laws of electrical circuits; equivalent circuits; DC and steady-state AC circuit analysis; and effective current, average power, and three-phase power.
Lecture: Three hours
Prerequisite: Analytic Geometry and Calculus I (MATH-131).

ELEC-309—Signals and Systems
Three Credit Hours
Required of electrical engineering juniors. The study of continuous and discrete systems utilizing Laplace, Fourier, and z-transform theory.
Lecture: Three hours
Prerequisites: Electric Circuit Analysis (ELEC-202), Electrical Laboratory (ELEC-204), Computer Applications for Electrical Engineers (ELEC-206). *Prerequisites* or *co-requisites*: MATH-335

ELEC-311—Digital Logic and Circuits
Three Credit Hours
Required of electrical engineering juniors. Introduction to Boolean algebra; topics such as digital data coding and digital arithmetic. Design of combinational and sequential circuits; design implementing and testing of digital circuits using Field Programmable Gate Arrays. Employs VHDL and other industry standard design tools.
Lecture: Three hours

ELEC-312—Systems I
Three Credit Hours
Required of electrical engineering juniors. An introduction to feedback control systems, system representation, stability, root-locus and frequency response, and compensation.
Lecture: Three hours
Prerequisites: Signals and Systems (ELEC-309)

ELEC-313—Electronics Laboratory
One Credit Hour
Required of electrical engineering juniors. Experimental studies coordinated with the subjects introduced in ELEC-306.
Laboratory: Two hours
Prerequisite: Electrical Laboratory (ELEC 204).
Co-requisite: Electronics I (ELEC-306).

ELEC-316—Electromechanical Energy Conversion
Three Credit Hours
Required of electrical engineering juniors.
Analysis of transformers; fundamentals of electromechanical energy conversion; and study of DC, induction, and synchronous machines.
Lecture: Three hours
Prerequisite: Signals and Systems (ELEC-309), or consent of the department head; *Prerequisite* or *Co-requisite*: Electrical Machinery Laboratory (ELEC-302).

ELEC-318—Electromagnetic Fields
Three Credit Hours

Required of electrical engineering juniors.
Static electric and magnetic fields; Maxwell's equations and their applications; Laplace's equations; boundary value problems; time varying fields, and plane waves.
Lecture: Three hours.
Prerequisites: Electric Circuit Analysis (ELEC-202), Physics with Calculus II/Laboratory for Physics with Calculus II (PHYS-222/272), Applied Engineering Mathematics II (MATH-335)

ELEC-330—Digital Systems Engineering
Three Credit Hours
Required of electrical engineering sophomores.
Microcontroller fundamentals including architecture, assembly language programming, and interfacing. Applications of industry- standard microcontrollers in embedded systems. Employs software design tools, simulators, and hardware trainers.
Lecture: Three hours
Prerequisite: Digital Logic and Circuits (ELEC-311).

ELEC-401—Electronics II
Three Credit Hours
Characteristics and applications of analog and digital circuits. Topics may include differential amplifiers, multistage amplifiers, power amplifiers, oscillators, filter circuits, and CMOS digital logic.
Prerequisite: Electronics I (ELEC-306), and Electronics Laboratory (ELEC-313).

ELEC-403—Electric Power Systems
Three Credit Hours
A study of electrical power generation, transmission, and distribution; symmetrical components, per-unit analysis, calculation of transmission-line parameters, and load flow.
Lecture: Three hours.
Prerequisites: Electromechanical Energy Conversion (ELEC-316), *Prerequisites or co-requisite:* Electromagnetic Fields (ELEC-318).

ELEC-405—Electrical Measurements
Three Credit Hours
An introduction to modern electrical instrumentation and measurements. Topics include: measurement theory, analog and digital signal conditioning, noise, transducers, instrumentation system design, digital interfaces, and computer based instrumentation and measurements.
Lecture: Three hours
Prerequisite: Electronics Laboratory (ELEC-313).

ELEC-407—Systems II
Three Credit Hours
A continuation of Systems I with primary emphasis on digital control systems. Topics include: state-variable analysis, simulation techniques, controllability, state-variable feedback, observability, and state estimator design.
Lecture: Three hours
Prerequisite: Systems I (ELEC-312).

ELEC-412—Applied Probability and Statistics for Engineers
Three Credit Hours
Required for electrical engineering majors.
Application of the theory of probability and statistics in modeling random phenomena and signals; in the calculation of system responses; and in making estimates, inferences and decisions in the presence of chance and uncertainty. Applications will be studied in areas such as communications, power systems, device modeling, measurements, reliability, and quality control.
Lecture: Three hours
Prerequisites: Analytic Geometry and Calculus III (MATH-231), Computer Applications for Electrical Engineers (ELEC-206).

ELEC 413—Advanced Topics in Electrical Engineering
Three Credit Hours

Advanced topics in electrical engineering. Offered occasionally when the special interests of students and faculty coincide. The syllabus must be approved by the Electrical Engineering Faculty. Since the content of the course may change, a student may repeat this course for credit with the permission of the department head.
Lecture: Three hours

ELEC-414—System Simulation
Three Credit Hours
An introduction to system concepts, mathematical models of systems, and simulation methods applied to a broad range of systems. Design project required.
Lecture: Three hours
Prerequisite: Systems (ELEC-312).

ELEC-416—Communications Engineering
Three Credit Hours
Principles of amplitude, frequency, and pulse modulation; signal flow and processing in communications systems; and analog and digital communication systems.
Lecture: Three hours
Prerequisites: Signals and Systems (ELEC-309) and Digital Logic and Circuits (ELEC-311), *Co-requisite:* Electronics 1 (ELEC-306)

ELEC-418—Advanced Digital Systems
Three Credit Hours
Experience in advanced digital design techniques and exposure to the development tools used in the design of advanced digital systems. Topics include the design of digital systems using VHDL, industry standard FPGA devices and software, and microprocessor hardware components.
Lecture: Three hours
Prerequisite or co-requisite: Digital Systems Engineering (ELEC-330) or Computer Organization and Programming (CSCI-305).

ELEC-419—Computer Network Architecture
Three Credit Hours
This course will cover network architecture and protocols. Included are transmission technologies, encoding/decoding schemes, packet switching, frame relay, ISDN, ATM and performance modeling techniques.
Lecture: Three hours

ELEC-421—Design I
Three Credit Hours
Required of electrical engineering seniors.
Initiation, design, scheduling, documentation and reporting on a major design project. Normally accomplished by students working in small groups. All students will make written and oral presentations on their contribution to the project. Financial, legal, ethical, societal, regulatory, environmental, manufacturability, and quality issues will be discussed and will constrain the designs as appropriate.
Lecture: One hour; Laboratory: Four hours.
Prerequisites: Electrical Machinery Laboratory (ELEC-302), Electronics I (ELEC-306), Systems I (ELEC-312), Electronics Lab (ELEC 313), Electromechanical Energy Conversion (ELEC-316), Digital Systems Engineering (ELEC-330) and Electromagnetic Fields (ELEC-318) or consent of the department head.

ELEC-422—Design II
Three Credit Hours
Required of all electrical engineering seniors. Continuation of the major design project begun in ELEC-421. Project implementation, documentation, and reporting. Normally to be accomplished by students working in the small groups formed in ELEC-421. The impact of the practical, societal, and governmental issues raised in ELEC-421 will be assessed. Each student will make written and oral presentations on their contributions to the project. A prototype demonstration and presentation of final results in a symposium format is required.
Lecture: One hour; Laboratory: Four hours
Prerequisite: Design I (ELEC-421) taken the preceding semester.

ELEC-423—Digital Signal Processing

Three Credit Hours
Introduction to the characteristics, design, and applications of discrete time systems using digital signal processors. Discrete time Fourier Transforms, FIR and IIR systems, and the design of FIR and IIR filters.
Lecture: Three hours
Prerequisite: Signals and Systems (ELEC-309), and Digital Systems Engineering (ELEC-330).

ELEC-424—Solid-State Devices
Three Credit Hours
Basic principles governing the operation of solid-state devices are developed from fundamental concepts. P-N junction theory is developed and applied to the analysis of devices such as bipolar transistors, solar cells, detectors, and photo devices. The theory of field-effect devices is developed.
Lecture: Three hours
Prerequisites: Physics with Calculus II/Laboratory for Physics with Calculus II (PHYS-222/272), Applied Engineering Mathematics I (MATH-234), and Electronics I (ELEC-306).

ELEC-425—Interference Control in Electronics
Three Credit Hours
An introduction to the control and measurement of interference between electronic devices. Analysis methods and practical design techniques to minimize both radiated and conducted emissions and susceptibility. Enhancing signal integrity in high-speed circuits and reducing crosstalk. Laboratory exercises and demonstrations will be used to reinforce the material.
Lecture: Three hours
Prerequisites: Signals and Systems (ELEC-309) and Electromagnetic Fields (ELEC-318).

ELEC-426—Antennas and Propagation
Three Credit Hours
Transmission, radiation, and propagation of electromagnetic waves by means of transmission lines, waveguides, optical fibers, and antennas. Design project required.
Lecture: Three hours
Prerequisites: Electromagnetic Fields (ELEC-318).

ELEC-427—Energy Systems Engineering
Three Credit Hours
An overview of current and emerging methods of energy conversion used to generate electricity and to support all methods of transportation. This basic look includes study of the thermodynamics, chemistry, flow and transport processes that apply to energy conversion with emphasis on sustainability, efficiency, environmental impact and performance. Systems utilizing fossil fuels, nuclear and renewable resources are studied. Study of energy storage and transmission is included as required to assess both stationary power generation and transportation energy needs.
Lecture: Three hours
Prerequisites: MATH 131and PHYS 221/271

ELEC-428—Computer Architecture
Three Credit Hours
Organization and design of computer system hardware. Provides the basic knowledge required for understanding and designing standard and advanced computer architectures. Topics include: instruction set architectures, ALU design and computer arithmetic, memory organization, cache and virtual memories, controller design, pipelining, and parallelism.
Lecture: Three hours
Prerequisite: Digital Systems Engineering (ELEC 330).

ELEC-430—Independent Research in Electrical Engineering
Three Credit Hours
This course may be taken by a student wishing to engage in research of mutual interest to the student and to the faculty advisor who directs the study. The student is required to; define a problem, conduct a review of relevant literature, develop an original solution to the problem, perform analysis and design as necessary, and perform experiments or simulations to evaluate the solution. The student is

required to consult the faculty advisor in-person at least once per week. The study will culminate in a formal written report, formatted in the style of a published conference-proceedings paper.
Prerequisites: Junior or senior standing, and department head approval.

ELEC-450—Electrical Engineering Internship
Three Credit Hours
The student on an individual basis, pursues advanced understanding by working for an electrical engineering company. The scope of the activities is tailored to the educational focus of the student in consultation with his faculty advisor and the supervisor of the company. The student is required to provide weekly journaling, monthly supervisor evaluations, a final presentation, and a final report on individual work accomplished.